

Applicant : Imad Mahawili, PhD
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IN THE CLAIMS:

Please cancel Claims 2, 22, and 33-54. Please enter new Claims 87-90. Please amend Claims 3, 5, 6, 8, 9, 11, 15, 17, 20, 23, 24, 29, and 30 as follows:

1-2. (cancelled)

3. (currently amended) The A reactor according to Claim 2, further comprising for processing a semiconductor substrate, said reactor comprising:

a reactor housing defining a processing chamber and being adapted to support the substrate in said processing chamber;

a plasma generator for ionizing at least one gas into a gas plasma;

at least one gas injector, said gas injector being adapted to inject the ionized gas into said processing chamber and onto the substrate supported therein for processing the substrate, wherein said housing includes a cover, said gas injector being supported in said cover;

a heater for selectively heating the substrate in said processing chamber; and

a heater housing supported in said reactor housing and enclosing said heater therein.

4. (cancelled)

5. (currently amended) The reactor according to Claim 3 22, wherein said plasma generator generates an electromagnetic field, said electromagnetic field for ionizing the gas into a gas plasma.

6. (currently amended) The reactor according to Claim 3 22, wherein said plasma generator ionizes said gas exteriorly of said processing chamber to isolate the substrate from said electromagnetic field.

7. (cancelled)

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8. (currently amended) The Δ reactor according to Claim 22, wherein for processing a semiconductor substrate, said reactor comprising:

a reactor housing defining a processing chamber and being adapted to support the substrate in said processing chamber;

a plasma generator for ionizing at least one gas into a gas plasma; and
at least one gas injector, said gas injector being adapted to inject the ionized gas into said processing chamber and onto the substrate supported therein for processing the substrate, wherein said housing includes a cover, said gas injector being supported in said cover, said gas injector includes including a plurality of orifices through which the ionized gas is delivered into said processing chamber.

9. (currently amended) The reactor according to Claim 3 22, wherein said gas injector comprises a quartz tube.

10. (cancelled)

11. (currently amended) The reactor according to Claim 8 22, wherein said gas injector further includes a supply tube and an injection tube, said supply tube in communication with said injection tube, said supply tube for delivering gas to said injection tube, and said plasma generator for ionizing the gas into a gas plasma in said supply tube.

12. (original) The reactor according to Claim 11, wherein said plasma generator includes a generator tube in communication with said supply tube and generates an electromagnetic field in said generator tube to ionize the gas flowing into said supply tube into a gas plasma.

13. (previously amended) The reactor according to Claim 12, wherein said supply tube has a larger diameter than said generator tube such that the gas undergoes dissociation and ionization within said supply tube.

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14. (original) The reactor according to Claim 13, where said supply tube comprises a quartz tube.

15. (currently amended) The reactor according to Claim 8 22, wherein said gas injector includes at least two gas injection tubes, one of said gas injection tubes injecting a first gas in said processing chamber, and a second of said gas injection tubes injecting a second gas in said processing chamber, and said gas injector ionizing at least one of said first and second gases into a gas plasma for injecting into said processing chamber.

16. (cancelled)

17. (currently amended) The reactor according to Claim 8 22, wherein said plasma generator includes a generator tube and a coil inducing an electromagnetic field in said generator tube to ionize the gas flowing through the generator tube, and said generator tube directing the ionized gas to said gas injector for injecting into said processing chamber.

18. (previously amended) The reactor according to Claim 17, further comprising a supply tube in communication with said gas injector, said generator tube directing the gas into the supply tube.

19. (original) The reactor according to Claim 18, wherein said supply tube has a greater diameter than said generator tube such that the gas under goes dissociation and ionization in said supply tube.

20. (currently amended) ~~The A reactor according to Claim 22~~ for processing a semiconductor substrate, said reactor comprising:

a reactor housing defining a processing chamber and being adapted to support the substrate in said processing chamber;

a plasma generator for ionizing at least one gas into a gas plasma; and

at least one gas injector, said gas injector being adapted to inject the ionized

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gas into said processing chamber and onto the substrate supported therein for processing the substrate, wherein said gas injector comprises an elongate tube with a plurality of orifices through which the gas is injected into said processing chamber.

21. (original) The reactor according to Claim 20, wherein said orifices are uniformly spaced along said elongate tube.

22. (cancelled)

23. (currently amended) The reactor according to Claim 3 22, wherein said plasma generator is supported by said cover exteriorly of said processing chamber to isolate the substrate from the plasma generator.

24. (currently amended) The reactor according to Claim 3 22, wherein said at least one gas injector comprises at least two gas injectors for injecting at least one gas into said processing chamber.

25. (original) The reactor according to Claim 24, wherein said gas injectors are isolated from each other to avoid contamination.

26. (original) The reactor according to Claim 25, wherein one of said gas injectors is adapted to inject a first gas into said processing chamber, and another of said injectors is adapted to inject a second gas into said processing chamber.

27. (original) The reactor according to Claim 26, wherein said plasma generator ionizes at least one of the first and second gases into a gas plasma for injection into the processing chamber.

28. (original) The reactor according to Claim 26, further comprising a heater for heating the substrate in said processing chamber.

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29. (original) The reactor according to Claim 30 28, wherein said heater selectively heats the substrate in said processing chamber.

30. (currently amended) The A reactor according to Claim 28 for processing a semiconductor substrate, said reactor comprising:

a reactor housing defining a processing chamber and being adapted to support the substrate in said processing chamber;

a plasma generator for ionizing at least one gas into a gas plasma;

at least one gas injector, said gas injector being adapted to inject the ionized gas into said processing chamber and onto the substrate supported therein for processing the substrate, wherein said housing includes a cover, said gas injector being supported in said cover, said at least one gas injector comprising at least two gas injectors for injecting at least one gas into said processing chamber, said gas injectors being isolated from each other to avoid contamination, wherein one of said gas injectors is adapted to inject a first gas into said processing chamber, and another of said gas injectors being adapted to inject a second gas into said processing chamber; and

a heater for heating the substrate in said processing chamber, wherein said heater is enclosed in a heater housing, said heater housing being supported in said reactor housing.

31. (original) The reactor according to Claim 30, wherein said heater housing provides support for the substrate in said reactor housing.

32-54. (cancelled)

55. (previously amended) The reactor according to Claim 30, wherein said heater housing is adapted for supporting the substrate in said processing chamber.

56. (previously presented) The reactor according to Claim 55, wherein said heater housing is

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adapted for rotatably supporting the substrate in said processing chamber.

57. (cancelled)

58. (previously amended) The reactor according to Claim 63, wherein said electromagnetic field generator comprises a plasma generator.

59-61. (cancelled)

62. (previously amended) The reactor according to Claim 63, wherein said electromagnetic field generator includes a generator tube in communication with said supply tube, said electromagnetic field generator generating said electromagnetic field in said generator tube to ionize gas flowing into said supply tube into a gas plasma.

63. (previously amended) A reactor for processing a semiconductor substrate, said reactor comprising:

a reactor housing defining a processing chamber and having a substrate support for supporting a substrate in said processing chamber; and

a gas injection system including an electromagnetic field generator generating an electromagnetic field exteriorly of said processing chamber and for injecting at least one gas into said processing chamber, said gas injection system passing said at least one gas through said electromagnetic field generated by said electromagnetic field generator wherein said gas is ionized exteriorly of said processing chamber, said gas injection system injecting said ionized gas into said processing chamber and onto the substrate supported therein for processing the substrate, said gas injection system including a gas manifold, said substrate support being adapted to rotate said substrate in said processing chamber whereby said gas manifold distributes the ionized gas uniformly over the substrate, said gas injection system further including an injection tube and a supply tube in communication with said injection tube, said injection tube having a plurality of orifices through which the ionized gas is delivered in said processing chamber, said supply tube for delivering the ionized gas to said

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injection tube, wherein said supply tube has a larger diameter than said generator tube such that the gas undergoes dissociation within said supply tube.

64-77. (cancelled)

78. (previously presented) The reactor according to Claim 63, wherein said gas injection tube comprises a quartz tube.

79. (previously presented) The reactor according to Claim 63, where said supply tube comprises a quartz tube.

80. (previously presented) The reactor according to Claim 63, wherein said gas injection assembly includes at least two gas injection tubes, one of said gas injection tubes injecting a first gas in said processing chamber, and a second of said gas injection tubes injecting a second gas in said processing chamber, and said gas injection assembly ionizing at least one of said first and second gases into a gas plasma for injecting into said processing chamber.

81. (previously presented) The reactor according to Claim 63, wherein said plasma generator includes a generator tube and a coil inducing an electromagnetic field in said generator tube to ionize the gas flowing through the generator tube, and said generator tube directing the ionized gas to said gas injector for injecting into said processing chamber.

82. (previously presented) The reactor according to Claim 63, wherein said orifices are uniformly spaced along said elongate tube.

83. (previously presented) The reactor according to Claim 63, wherein said housing includes a cover, said gas injector being supported in said cover.

84. (previously presented) The reactor according to Claim 63, further comprising a heater for heating the substrate in said processing chamber.

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85. (previously presented) The reactor according to Claim 63, wherein said heater is enclosed in a heater housing, said heater housing being supported in said reactor housing.

86. (previously presented) The reactor according to Claim 63, wherein said heater housing provides support for the substrate in said reactor housing.

87. (new) The reactor according to Claim 20, wherein said plasma generator generates an electromagnetic field, said electromagnetic field for ionizing the gas into a gas plasma.

88. (new) The reactor according to Claim 87, wherein said plasma generator ionizes said gas exteriorly of said processing chamber to isolate the substrate from said electromagnetic field.

89. (new) The reactor according to Claim 88, wherein said housing includes a cover, said elongate tube being supported in said cover.

90. (new) The reactor according to Claim 20, wherein said plasma generator includes a generator tube in communication with said gas injector, said plasma generator generating an electromagnetic field in said generator tube to ionize the gas flowing to said gas injector into a plasma.